

## **CLAIMS**

1. A magnesium-based, semi-solid casting alloy having improved elevated temperature performance when cast from a semi-solid alloy slurry, the alloy comprising, in weight percent, from about 3 to 7% aluminum, from about 0.5 to 3% strontium, with the balance being magnesium, except for impurities commonly found in magnesium alloys, wherein, the semi-solid alloy slurry includes up to about 20% of a solid fraction by weight.

2. The magnesium-based, semi-solid casting alloy of claim 1, wherein the alloy comprises 4.5 to 5.5% aluminum.

3. The magnesium-based, semi-solid casting alloy of claim 1, wherein the alloy comprises from 1.2 to 2.2% strontium.

4. The magnesium-based, semi-solid casting alloy of claim 2, wherein the alloy comprises from 1.2 to 2.2% strontium.

5. The magnesium-based, semi-solid casting alloy of claim 1, wherein when cast, the casting has an average % creep deformation at 150°C of less than or equal to about 0.04%, an average ultimate tensile strength at 150°C of at least about 174 MPa, an average tensile yield strength at 150°C of at least about 112 MPa, and an average % elongation at 150°C of less than or equal to about 20%.

6. The magnesium-based, semi-solid casting alloy of claim 5, wherein when cast, the casting has an average % creep deformation at 150°C of about 0.04%, an average ultimate tensile strength at 150°C of about 174 MPa, an average tensile yield strength at 150°C of about 112 MPa, and an average % elongation at 150°C of about 20%.

7. A magnesium-based, semi-solid casting alloy having improved elevated temperature performance when cast from a semi-solid alloy slurry, the alloy comprising, in weight percent, from about 3 to 7% aluminum, from about 0.5 to 3% strontium, with the balance being magnesium, except for impurities commonly found in magnesium alloys, wherein, the semi-solid alloy slurry includes up to about 5% of a solid fraction by weight.

8. The magnesium-based, semi-solid casting alloy of claim 7, wherein the alloy comprises from 4.5 to 5.5% aluminum.

9. The magnesium-based, semi-solid casting alloy of claim 7, wherein the

alloy comprises from 1.2 to 2.2% strontium.

10. The magnesium-based, semi-solid casting alloy of claim 8, wherein the alloy comprises from 1.2 to 2.2% strontium.

11. The magnesium-based, semi-solid casting alloy of claim 7, wherein when cast, the casting has an average % creep deformation at 150°C of less than or equal to about 0.04%, an average ultimate tensile strength at 150°C of at least about 183 MPa, an average tensile yield strength at 150°C of at least about 116 MPa, and an average % elongation at 150°C of less than or equal to at least about 17%.

12. The magnesium-based, semi-solid casting alloy of claim 11, wherein when cast, the casting has an average % creep deformation at 150°C of about 0.04%, an average ultimate tensile strength at 150°C of about 183 MPa, an average tensile yield strength at 150°C of about 116 MPa, and an average % elongation at 150°C of about 17%.

13. The magnesium-based, semi-solid casting alloy of claim 1, wherein the casting is cast using a thixotropic casting process.

14. The magnesium-based, semi-solid casting alloy of claim 7, wherein the casting is cast using a thixotropic casting process.

15. The magnesium-based, semi-solid casting alloy of claim 1, wherein the alloy has a structure including primary magnesium particles having a mean size of from about 20 to about 150  $\mu\text{m}$  in a matrix of grains of magnesium having a mean size of from about 5  $\mu\text{m}$  to about 20  $\mu\text{m}$  reinforced with  $\text{Al}_4\text{Sr}$  intermetallic homogeneously dispersed particles having a mean size of from about 1  $\mu\text{m}$  to about 10  $\mu\text{m}$ .

16. The magnesium-based, semi-solid casting alloy of claim 7, wherein the alloy has a structure including primary magnesium particles having a mean size of from about 20 to about 150  $\mu\text{m}$  in a matrix of grains of magnesium having a mean size of from about 5  $\mu\text{m}$  to about 20  $\mu\text{m}$  reinforced with  $\text{Al}_4\text{Sr}$  intermetallic homogeneously dispersed particles having a mean size of from about 1  $\mu\text{m}$  to about 10  $\mu\text{m}$ .

17. A magnesium-based casting having improved elevated temperature performance when cast from a semi-solid alloy slurry, the slurry comprising, in

weight percent, from about 3 to 7% aluminum, from about 0.5 to 3% strontium, with the balance being magnesium, except for impurities commonly found in magnesium alloys, wherein, the semi-solid alloy slurry includes up to about 20% of a solid fraction by weight.

18. The magnesium-based casting of claim 17, wherein the casting comprises from 4.5 to 5.5% aluminum.

19. The magnesium-based casting of claim 17, wherein the alloy comprises from 1.2 to 2.2% strontium.

20. The magnesium-based casting of claim 18, wherein the alloy comprises from 1.2 to 2.2% strontium.

21. The magnesium-based casting of claim 17, wherein the casting has an average % creep deformation at 150°C of less than or equal to about 0.04%, an average ultimate tensile strength at 150°C of at least about 174 MPa, an average tensile yield strength at 150°C of at least about 112 MPa, and an average % elongation at 150°C of less than or equal to about 20%.

22. The magnesium-based casting of claim 21, wherein the casting has an average % creep deformation at 150°C of about 0.04%, an average ultimate tensile strength at 150°C of about 174 MPa, an average tensile yield strength at 150°C of about 112 MPa, and an average % elongation at 150°C of about 20%.

23. A magnesium-based casting having improved elevated temperature performance when cast from a semi-solid alloy slurry, the slurry comprising, in weight percent, from about 3 to 7% aluminum, from about 0.5 to 3% strontium, with the balance being magnesium, except for impurities commonly found in magnesium alloys, wherein, the semi-solid alloy slurry includes up to about 5% of a solid fraction by weight.

24. The magnesium-based casting of claim 23, wherein the casting comprises from 4.5 to 5.5% aluminum.

25. The magnesium-based casting of claim 23, wherein the casting comprises from 1.2 to 2.2% strontium.

26. The magnesium-based casting of claim 24, wherein the casting comprises from 1.2 to 2.2% strontium.

27. The magnesium-based casting of claim 23, wherein when cast, the casting has an average % creep deformation at 150°C of less than or equal to about

0.04%, an average ultimate tensile strength at 150°C of at least about 183 MPa, an average tensile yield strength at 150°C of at least about 116 MPa, and an average % elongation at 150°C of less than or equal to about 17%.

28. The magnesium-based casting of claim 27, wherein when cast, the casting has an average % creep deformation at 150°C of about 0.04%, an average ultimate tensile strength at 150°C of about 183 MPa, an average tensile yield strength at 150°C of about 116 MPa, and an average % elongation at 150°C of about 17%.

29. The magnesium-based casting of claim 17, wherein the casting is cast using a thixotropic casting process.

30. The magnesium-based casting of claim 23, wherein the casting is cast using a thixotropic casting process.

31. The magnesium-based semi-solid casting of claim 17, wherein said alloy has a structure including primary magnesium particles having a mean size of from about 20 to about 150  $\mu\text{m}$  in a matrix of grains of magnesium having a mean size of from about 5  $\mu\text{m}$  to about 20  $\mu\text{m}$  reinforced with  $\text{Al}_4\text{Sr}$  intermetallic homogeneously dispersed particles having a mean size of from about 1  $\mu\text{m}$  to about 10  $\mu\text{m}$ .

32. The magnesium-based semi-solid casting of claim 23, wherein said alloy has a structure including primary magnesium particles having a mean size of from about 20 to about 150  $\mu\text{m}$  in a matrix of grains of magnesium having a mean size of from about 5  $\mu\text{m}$  to about 20  $\mu\text{m}$  reinforced with  $\text{Al}_4\text{Sr}$  intermetallic homogeneously dispersed particles having a mean size of from about 1  $\mu\text{m}$  to about 10  $\mu\text{m}$ .